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Some data for oat growers

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Iowa State College

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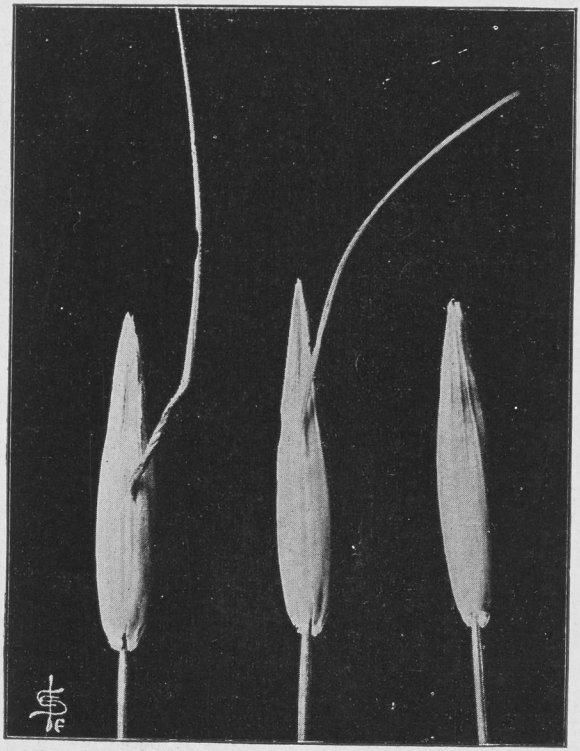
SOME DATA FOR OAT GROWERS



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IOWA STATE COLLEGE OF AGRICULTURE
AND THE MECHANIC ARTS

FARM CROPS SECTION
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Variety test plats Iowa Agricultural Experiment Station. The experiments recorded in this bulletin were conducted in these and other fields at Iowa State College.

SOME DATA FOR OAT GROWERS.

BY L. C. BURNETT.

I. INTRODUCTION.

Following the publication of the Iowa Agricultural Experiment station's last bulletin on Oats, in March, 1908, a number of additional experiments with this cereal were inaugurated which are now drawing toward completion.

The variety test was increased to cover all of the kinds generally grown in the state; others, some new and some well known, were imported from the irrigated and "dry-farming" districts of the west, from Canada, Michigan, Missouri and Illinois, and from Scotland and England. Other experiments were undertaken upon the size and weight of seed and upon the rate and method of seeding. These, while as yet incomplete, are showing some tendencies which are valuable and should now be made public.

From the variety tests we find certain types adapted to certain soils and conditions. Buying heavy seed in the open market does not show satisfactory returns for the money invested. The value of repeated fanning of seed oats has been overestimated. Long-time tests with drilling vs. broadcasting give more favorable results for the drill. Heavy seeding we find more profitable than is usually considered to be the case.

It must be borne in mind that all of the data of the Iowa station is collected from experiments conducted at Ames and due allowance must be made when the conclusions are applied to crops grown in other locations and on other types of soil. For instance, the same rate of seeding probably will not give the same results upon the drift soils of Story county, the loess of the western part of the state, and the bottom lands of the Missouri river. This is likewise true of other conclusions which may be offered in this bulletin. But the reader will find the general tendencies to be the same, even though the degree of variation seems to be more or less marked upon the land where his own crops are grown.

Conclusions from experiments such as are quoted in this bulletin can be drawn only when the work has been pursued through several years. There is such variation between the seasons, in temperature, humidity, and the distribution of sunshine, that un-

less tests have been conducted over a period of years the calculations will be too narrow and may not be *generally* true. It is not enough to repeat the experiment several times in one season and consider the conclusions adequate.

It has been the aim of the writer to give all the reliable evidence obtainable, and to interpret it so that the conclusions will be as sound as possible. In doing this, data have been drawn from the earlier work with oats quoted in Bulletin No. 96, as well as from the last four years' work. Experiments from other stations have also been drawn upon where applicable. In all cases the greatest possible range has been given, both as to soil and season, as it is only by so doing that dependable calculations can be made.

II. TYPES AND VARIETIES OF OATS.

a. A Classification of Oat Types.
b. A Classification of Oats for Shows.
c. A Test of the Value of Varieties.

Although seed catalogs and crop publications abound in variety names, there are in reality only about a dozen true and distinct types of oats. Seed buyers who chance upon an unusual field of oats that is for sale, endeavor to procure the original name from the grower. If unsuccessful, which is often the case, a new name is at once given to the lot. Sometimes the name of the grower is used, as Daubeney, Myrick or Johnson; sometimes a name better suited to advertising purposes, like National, Big Four, Mortgage Lifter or White Bonanza. This strife over the introduction of varieties has been entered into, not only by commercial seedsmen, but even by government explorers. We now have in the country the Sixty Day and Kherson, two names for identically the same variety.

When grown on the heavy soil of the corn-belt states, the oat plant varies to a considerable extent and so it is not uncommon for two fields of the same oats to show some decided differences. But when these so-called varieties are grown on the same field in plats that lie side by side, these differences disappear in one or two generations.

(a) CLASSIFICATION OF OAT VARIETIES.

The following outline is offered to aid in giving newly-named varieties their proper place.

The centgener-bred and hybrid strains cannot be included in this list, though they may be appended as sub-varieties. The

small amount of this seed that is in the market, however, makes this of little consequence to the oat growers of Iowa.

It may be safely said, then, that with the exception of these two small classes, only sixteen distinct kinds of oats are now known and less than a dozen are at all common in the corn belt. In time we may expect the addition of one or two more classes: a white, winter, and a black early variety; but at present we have no knowledge of these.

The following key is based upon the work of J. B. Norton, formerly in charge of the oat breeding investigations for the U. S. Department of Agriculture. It has been supplemented and rearranged by the author with the idea of aiding students and judges of oats:

GROUP	SUB-GROUP	TYPE	TYPICAL VARIETIES
Naked Oats		Hulless	All Hulless Varieties
Red Oats	Rust proof		Asia Minor Rust proof Red Texas Burt
Winter Oats	Gray		Virginia Gray Winter Turf
	Black		Belgian Winter Arctic Black Winter
Early Oats (open head)	White	Champion	Early Champion Fourth of July
	Yellow	Sixty Day	Kherson Sixty Day
Medium Oats (open head)	White Medium to medium early	Silver Mine	Silver Mine Great American
		Swedish	Swedish Select Big Four
		Potatoe	Mortgage Lifter White Bonanza
	Colored Medium to medium late	Yellow	Green Russian
		Gray	Calgary Gray
		Brown	Red Crown
		Black	Joanette
Late Oats (side oats)	White		White Russian White Tartar
	Colored	Yellow	Golden Giant
		Black	Black Beauty Black Tartarian

CLASSIFICATION OF OATS FOR SHOWS.

Open to

World	United States	Corn Belt States
Naked oats—Hulless		
Red oats: Rust proof, Burt	Red oats*: Rust proof, Burt	Red oats—Rust proof
Winter oats: Gray, Black	Winter oats*: Gray, Black	
Early oats: White, Colored	Early oats: White, Colored	Early oats: White, Yellow
Medium oats: White: Silver Mine, Swedish, Potatoe	Medium oats: White: Silver Mine, Swedish, Potatoe	Medium: White*: Silver Mine, Swedish, Potatoe
Medium oats: Colored: Yellow, Gray, Brown, Black	Medium oats: Colored: Yellow, Other than Yellow	Medium: Colored: Yellow, Other than Yellow
Side oats: White	Side oats: White	Side oats: White
Side oats: Colored: Yellow, Black	Side oats: Colored	Side oats: Colored

*Division optional.

NOTE.—Yellow oats are considered as colored oats. In the corn-belt states this will even up classes.

A convenient form for printing this classification in a premium list is given at the end of this bulletin, on page 126. It may be of interest to those concerned with grain shows.

(b) CLASSIFICATION OF OATS FOR SHOWS.

The impracticability of making a class for each of the groups and sub-groups in any Iowa show is evident. In an exposition open to the world this might be reasonable, but even then care should be exercised that the honors are distributed in the proportion in which the types will be shown. In the corn-belt states four of these types predominate: The Early Champion, Sixty Day, Swedish and the Green Russian. There is, however, an increasing favor shown the Sixty Day type. In all shows the bulk of the honor should be given to the types which are of economic importance.

(c) THE VARIETY TEST.

The growing of various types and varieties of oats under like conditions for a comparison of their performance has proven of great value at all experiment stations. Different types of soil and climate require different types of plants. The long cool season of Scotland, extending from early March until late in August, favors quite a different oat plant from the short hot season of the corn belt. Just the type best suited to any set of conditions can be determined only by a trial under those conditions. In order to determine the relative merits of varieties it is necessary to grow many kinds under uniform conditions, and to judge and record the performance of each without prejudice.

It should be stated in this connection that the personal factor of prejudice is one of the hardest to eliminate from the records of experiments. It is the endeavor of the workers at this station to show absolute fairness, and every precaution is taken to eliminate all factors that go to produce "pets." High-priced varieties are never grown with the hope of making money out of some seedsman's advertising. This station advertises no varieties and has no "seed oats" for sale.* Any favor which a variety may gain must be won by its performance record. The aim has been to practice a conservative severity with every plat, to lessen differences instead of magnifying them and to draw conclusions only from averages obtained from several trials.

The variations shown are usually small, but when multiplied by the number of trials and seasons over which they extend, they are very reliable and show differences which may not be underestimated.

The following tables, Nos. 1 and 2, show the detailed results of the last three years' work. Only the figures of general interest are given in these tables, but a complete record of every plat is

*The station does endeavor to maintain a list of reliable farmers and seedsmen who have seed grain for sale. This information will be sent to anyone upon request, and a statement of the variety and amount required together with the locality where it is to be planted.

TABLE NO. 1—SHOWING THREE-YEAR PERFORMANCE RECORDS OF 48 COMMERCIAL VARIETIES IN TEST.

	Variety	1908 Date Ripe	1908 Ht.	1908 Ldgd	1908 Yld. per acre	1908 Wt. per bu.	1909 Date Ripe	1909 Ht.	1909 Ldgd	1909 Yld. per acre	1909 Wt. per bu.	1910 Date Ripe	1910 Ht.	1910 Ldgd	1910 Yld. per acre	1910 Wt. per bu.
			In.	%	Bu.	Lbs.		In.	%	Bu.	Lbs.		In.	%	Bu.	Lbs.
1	White Alaska	7–15	37	5	36.5	26½	7–19	35	0	28.7	28½	7– 7	35	0	58.7	33¼
2	Early Champion	15	36	1	37.5	25	19	36	0	24.7	29	7	35	0	61.9	33¼
3	Sixty Day	15	35	0	50.0	29	19	33	0	31.2	25½	7	30	0	67.8	29½
4	Kherson	15	36	0	48.8	29½	19	34	0	35.3	26½	8	39	0	62.2	31
5	New Sixty Day	15	34	5	45.2	27½	19	35	0	50.0	26	9	27	0	57.8	31¾
6	Daubeney (Darson Hunter)						7–23	40	0	38.1	30	7–12	34	0	53.7	33¼
7	Johnson	7–24	43	25	37.8	19½	28	37	0	32.8	26	15	33	0	59.7	31½
8	White Bonanza	26	41	10	26.9	23	28	42	0	29.7	31	17	36	0	57.2	34
9	Canadian	23	41	40	15.6	20	31	38	0	33.1	36	15	39	25	85.3	35
10	Green Russian	26	43	2	39.4	23	28	41	0	33.4	28	16	34	0	64.1	32
11	Bruner	7–26	43	2	39.4	23	7–28	40	0	30.6	27	7–16	35	0	63.4	32
12	Silver Mine	26	41	2	36.6	19¾	28	39	0	31.6	30½	17	36	0	70.6	34¼
13	Daubeney (Steel Briggs)						29	48	0	56.5	30	19	38	0	64.3	33¼
14	Green Mountain						30	44	0	31.6	31½	19	36	0	81.2	32¼
15	Swedish Select	25	42	10	31.0	25	28	41	0	33.1	24	19	35	0	62.2	32¼
16	Regenerated Swedish Select (Imp. 1908)	7–28	46	98	15.0	20	7–28	40	0	28.8	24½	7–18	36	0	60.6	32¼
17	New Market						28	38	0	36.9	31	20	35	0	63.7	33½
18	Big Four	26	44	17	30.0	18	29	40	0	33.4	28½	18	36	0	73.1	32½
19	National	26	40	50	31.6	20¾	29	43	0	28.1	26	18	37	0	61.9	32
20	Irish Victor	25	41	12	33.8	19	29	39	0	33.4	28½	19	37	0	66.2	32
21	Minnesota No. 6	26	42	37	30.6	23¼	28	42		32.2	26	7–19	36	0	65.0	32¾
22	Minnesota No. 26	26	43	2	35.3	19	29	40	0	29.4	27	17	30	0	60.3	32¾
23	Early Gotham	26	42	3	33.7	20	29	38	0	35.9	29½	18	35	0	70.6	32
24	Prosperity	27	47	69	16.6	18½	29	47	0	28.1	30	18	35	0	56.6	34½

TABLE NO. 1—SHOWING THREE-YEAR PERFORMANCE RECORDS OF 48 COMMERCIAL VARIETIES IN TEST.

	Variety	1908 Date Ripe	1908 Ht.	1908 Ldgd	1908 Yld. per acre	1908 Wt. per bu.	1909 Date Ripe	1909 Ht.	1909 Ldgd	1909 Yld. per acre	1909 Wt. per bu.	1910 Date Ripe	1910 Ht.	1910 Ldgd	1910 Yld. per acre	1910 Wt. per bu.
			In.	%	Bu.	Lbs.		In.	%	Bu.	Lbs.		In.	%	Bu.	Lbs.
25	Siberian	7–25	41	2	36.6	19¾	7–28	42	0	31.9	30½	7–19	33	0	59.4	32¾
26	Lincoln	26	40	2	28.1	22	28	39	0	34.4	28½	18	35	0	62.2	34½
27	Tartar King	26	42	7	28.1	22½	28	42	0	37.8	30½	18	34	0	60.3	33¾
28	Winter's Farm Pedigree	26	44	12	22.8	20½	30	45	0	33.7	29	18	36	0	63.4	34½
29	Probesteier	25	39	0	28.1	23½	30	40	0	27.5	27	18	40	0	61.9	33½
30	American Clydesdale	25	41	0	30.6	25	30	41	0	30.3	28	19	35	0	54.7	35¼
31	Imported Clydesdale (Imp. 1907)	7–25	39	0	30.6	24½	7–30	42	0	30.3	26	7–20	36	0	58.4	34¾
32	Great American	28	40	20	20.6	18	28	46	0	34.4	30	20	35	0	61.6	33½
33	Progress	28	48	95	15.6	16	30	38	0	23.1	27	19	33	0	57.2	34
34	Triumph	28	48	95	18.7	15	30	43	0	34.4	32	19	32	0	50.9	34¼
35	Regenerated Silver Mine	28	46	95	18.7	15	30	35	0	34.4	32	20	38	0	57.5	34¼
36	Irish Victor (Portland)	7–28	49	98	18.1	15	8– 2	31	0	28.1	31	7–19	37	0	60.6	31½
37	President (Garton's)	29	45	95	6.2	18	7–31	42	0	26.2	24½	19	38	0	66.6	27
38	Myrick	26	42	7	38.1	22	30	38	0	32.5	29	22	40	0	91.9	32½
39	Colorado No. 37	28	41	50	16.9	20	31	36	0	41.6	30½	19	31	0	42.5	34
40	Colorado No. 13	.....	.....	.....	.....	.....	23	35	0	40.0	28	20	37	0	60.3	30½
41	Danish	7–27	36	35	15.0	18	8– 2	31	0	31.2	30	7–20	35	0	51.2	30
42	Joanette	26	35	2	28.4	23¼	7–31	33	0	33.1	26½	22	30	0	60.3	33½
43	Record	24	37	0	11.2	19	30	31	0	34.4	26	16	31	0	60.3	32
44	Red Texas	29	36	0	41.9	22	30	36	0	32.8	25	25	35	0	66.6	33¼
45	White Russian	31	40	0	25.6	20	8– 5	45	0	45.6	31½	24	36	0	60.0	31
46	American Banner	7–31	47	35	18.7	17	8– 5	44	0	40.6	31	7–24	35	0	63.4	31½
47	White Tartar	8– 1	47	5	24.4	24	5	41	0	29.1	29½	24	35	0	73.1	30½
48	Two Foot Oats (Salzer)	1	44	15	17.5	25	5	38	0	30.3	28	24	38	0	54.1	33

TABLE NO. 2—SHOWING THE AVERAGE PERFORMANCE OF VARIETIES IN TEST.

	Variety	3 yrs.—'08 to '10				5 yrs. '06 to '10				7 yrs. '04 to '10			
		Date Ripe	Ht.	Ldgd	Yld. per acre	Wt. per bu.	Date Ripe	Ldgd	Yld. per acre	Wt. per bu.	Date Ripe	Ldgd	Yld. per acre	Wt. per bu.
			In.	%	Bu.	Lbs.		%	Bu.	Lbs.		%	Bu.	Lbs.
1	White Alaska	7–13	35	2	41.3	29½	7–13	4	42.4	29¾	7–13	13	41.9	30
2	Early Champion	13	36	0.3	41.4	29	13	5	41.6	29	13	11	42.8	30
3	Sixty Day	13	33	0	50.6	28	13	5	50.7	28¼	.....	.....	.....	.....
4	Kherson	14	33	0	48.8	29	13	7	50.7	29½	14	10	56.5	30
5	New Sixty Day	14	32	2	51.0	28¼	.....	.....	.....	.....	.....	.....	.....	.....
6	Daubeney (Darson Hunter, 2 yr.)	7–17	37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	Johnson	22	38	8	43.5	23¾	.....	.....	.....	.....	.....	.....	.....	.....
8	White Bonanza	23	40	3	38.0	29¼	.....	.....	.....	.....	.....	.....	.....	.....
9	Canadian	23	39	22	44.6	30¼	22	17	43.9	29¾	.....	.....	.....	.....
10	Green Russian	23	39	1	45.7	27¾	23	0.6	47.7	28	.....	.....	.....	.....
11	Bruner	7–23	39	1	44.4	27¼	23	4	45.1	26¼	.....	.....	.....	.....
12	Silver Mine	23	39	1	46.4	28	22	3	50.2	27¾	22	19	51.9	28¼
13	Daubeney, (Steel Briggs 2 yrs.)	24	43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	Green Mountain (2 yrs.)	24	40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	Swedish Select	24	39	3	42.1	27	23	9	46.2	27½	22	23	47.9	28¼
16	Regenerated Swedish Select (Imp. 1908)	7–24	41	33	34.8	25½	.....	.....	.....	.....	.....	.....	.....	.....
17	New Market (2 yrs.)	24	37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	Big Four	24	40	6	45.5	26¼	.....	.....	.....	.....	.....	.....	.....	.....
19	National	24	40	17	40.6	26¼	24	13	41.2	27½	23	23	45.8	28½
20	Irish Victor	24	39	4	44.4	26½	23	5	46.0	26¼	23	15	46.0	26¾
21	Minnesota No. 6	7–24	40	12	42.9	27¼	23	10	43.8	26½	18	20	46.0	26½
22	Minnesota No. 26	24	38	1	41.6	26¼	23	2	44.4	26	23	19	47.1	26
23	Early Gotham	24	38	1	46.7	27¼	23	3	48.8	26¼	.....	.....	.....	.....
24	Prosperity	24	43	23	33.8	27¾	.....	.....	.....	.....	.....	.....	.....	.....

TABLE NO. 2—SHOWING THE AVERAGE PERFORMANCE OF VARIETIES IN TEST.

	Variety	3 yrs.—'08 to '10					5 yrs. '06 to '10				7 yrs. '04 to '10			
		Date Ripe	Ht.	Ldgd	Yld. per acre	Wt. per bu.	Date Ripe	Ldgd	Yld. per acre	Wt. per bu.	Date Ripe	Ldgd	Yld. per acre	Wt. per bu.
			In.	%	Bu.	Lbs.		%	Bu.	Lbs.		%	Bu.	Lbs.
25	Siberian	7–24	39	1	42.7	27¾	7–23	3	43.0	27	7–24	2	42.5	26
26	Lincoln	24	38	1	41.5	28¼								
27	Tartar King	24	39	2	42.1	29	23	5	41.1	28½	22	14	39.5	27¼
28	Winter's Farm Pedigree	24	42	4	40.0	28								
29	Probesteier	24	40	0	39.1	28								
30	American Clydesdale	24	39	0	38.5	29½								
31	Imported Clydesdale, (Imp. 1907)	7–25	39	0	36.9	28¼								
32	Great American	25	40	7	38.9	27¼								
33	Progress	25	40	32	32.0	23¾								
34	Triumph	25	41	32	26.4	27½								
35	Regenerated Silver Mine	26	40	32	36.9	27								
36	Irish Victor, (Portland)	7–26	39	33	35.6	25¾								
37	President	26	42	32	33.0	23¼								
38	Myrick	26	40	2	54.1	27¾	24	3	54.6	26½				
39	Colorado No. 37	26	36	17	37.0	28¼								
40	Colorado No. 13, (2 yrs.)	26	36											
41	Danish	7–26	34	12	32.5	26	25	9	37.1	25½				
42	Joanette	26	33	1	40.6	27¾	25	2	43.4	28	24	14	45.9	27
43	Record	26	33	0	35.3	23¾								
44	Red Texas	28	36	0	47.1	26¾								
45	White Russian	30	40	0	43.8	27½	29	1	45.4	27¼	30	21	47.9	28½
46	American Banner	7–30	42	12	40.9	26½								
47	White Tartar	30	41	2	42.2	28	29	2	43.5	28				
48	Two Foot Oats, (Salzers)	30	40	5	34.0	28¾								

on file and any further information desired will be furnished upon request.

SEVEN REPRESENTATIVE TYPE VARIETIES.

The varieties of oats common to the state of Iowa are very limited in number. In order to avoid confusion, seven of the best known have been taken from the general mass of figures and are here shown in a table by themselves. The data given summarizes seven years' work, this being the longest period over which comparable averages are obtainable. In table No. 3 the varieties are arranged in order of maturity, from the earliest to the latest.

TABLE NO. 3—SHOWING THE AVERAGE RESULTS OF A SEVEN-YEAR TEST WITH SEVEN COMMON IOWA VARIETIES: 1904-1910.

	Variety	Earliest date ripe	Latest date ripe	Average Date ripe	Per cent ldgd.	Bu. per A.	Wt. per Bu.
1	Early Champion	7– 7–10	7–19–07 & 09	7–13	11	41.9	30
2	Kherson	7– 8–06 & 10	7–19–07 & 09	7–14	10	55.9	30
3	Silver Mine	7–17–10	7–28–09	7–22	19	52.3	28¼
4	Swedish Select	7–16–04	7–28–09	7–22	23	48.3	28¼
5	Siberian	7–19–10	7–29–05	7–24	2	43.1	26
6	*Green Russian	7–16–10	7–28–09	7–23	0.5	48.5	28½
7	White Russian	7–24–10	8– 5–09	7–30	21	47.2	28½

*Six years.

Table No. 4 shows the results of the same test arranged in order of yield per acre. The columns labeled gain and loss are figures from the average of the seven varieties.

TABLE NO. 4—SHOWING COMPARATIVE VALUE OF SEVEN VARIETIES.

Variety	Average Production per acre for 7 years	Gain or Loss		Total Production per acre for 7 years	Gain or Loss	
	Bu.	Bu.	$ @ .33 1-3 per Bu.	Bu.	Bu.	$ @ .33 1-3 per Bu.
Kherson	55.9	+7.5	+$2.50	392	+53	+$17.67
SilverMine	52.3	+3.9	+ 1.30	366	+27	+ 9.00
Green Russian	48.5	+ .1	+ .03 1-3	*340	+ 1	+ .33 1-3
Average	*48.4*	*0*	*00*	*339*	*0*	*00*
Swedish Select	48.3	– .1	– .03 1-3	338	– 1	– .33 1-3
White Russian	47.2	–1.2	– .40	330	– 9	– 3.00
Siberian	43.1	–5.3	– 1.77	302	–37	– 12.33
Early Champion	41.9	–6.5	– 2.17	293	–46	– 15.33

*Six year yield 291.1 bu.

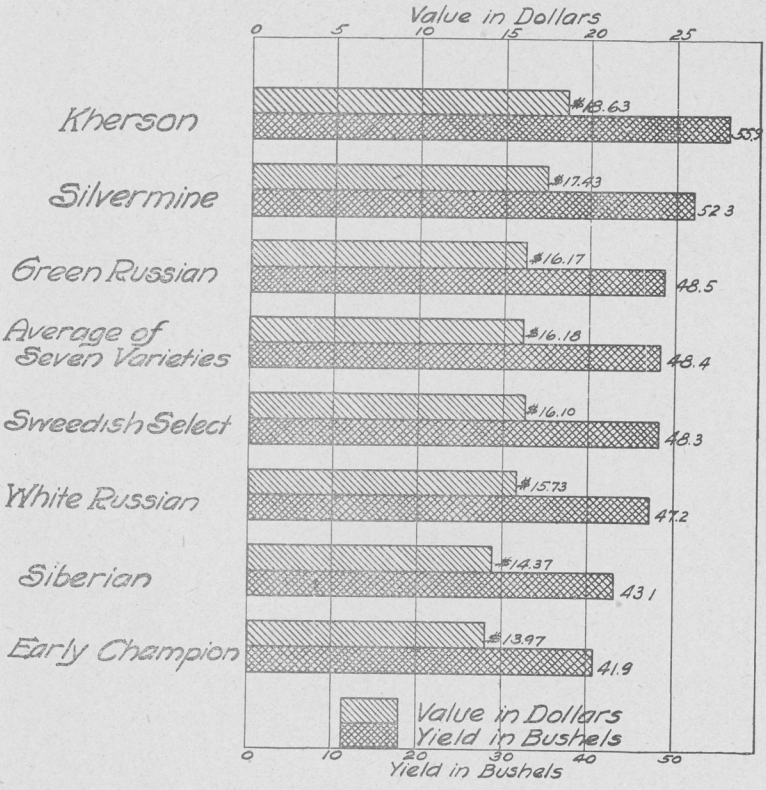

Figure I.—Showing the average yield per acre and value per acre of 7 of Iowa's most common varieties of oats in a 7-year test, 1904 to 1910.

These figures show that for the conditions that exist at Ames, the Kherson oat yields 7.5 bushels per acre more than the average of our standard varieties. Figured at a value of 33 1-3 cents per bushel, it gives a return of $2.50 per acre more than the average. All the calculations are made from the figures in the three right hand columns, which show the actual yield per acre for the seven-year period.

The chart in Figure I shows graphically the average yield and value, at 33 1-3 cents per bushel, for the seven varieties.

It must not be inferred that varieties best adapted to Story county are necessarily best adapted to all localities. The lesson taught by this experiment is that the difference in yield between the best variety and the average variety (not the poorest, but the average variety) is $2.50 per acre. It costs about $12.00 to produce an acre of oats. The use of the best variety means twenty per cent (20%) interest on the investment.

III. "QUALITY" IN SEED OATS.

a. What is Meant by Quality
b. Improving Quality by Importation.
c. Improving Quality by Fanning and Grading.

Some amazing conclusions and theories about quality of seed have been promulgated, but the term, when applied to seed grain, can mean only one thing: That the seed will produce plants that in turn will give the most economic results. It need not mean appearance in a show; it may not mean weight of kernel; it often does not mean size of kernel. It does mean that the kernel contains a live, strong, healthy germ that will produce a plant capable of withstanding the hardships of the soil and climate where it is to be grown.

The question of quality in seed oats presents itself to the Iowa farmer most forcibly the spring following a partial crop failure. The seed obtained from such a crop is usually light in weight, and if the next crop is to be produced with profit the quality must be improved. Two methods for accomplishing this present themselves at once: By procuring good seed from some outside source, or by improving the home-grown seed by fanning and grading to select the best kernels. Both these methods have been experimented with at this station, and while the work has not been carried far enough for final conclusions, much useful information is already available.

(b) IMPROVEMENT BY IMPORTATION.

Attempts to secure improvement by the importation of seed oats usually follows a light-weight crop. When the oats of the previous year are not properly filled, the best seed that can be obtained from it will often be below standard weight. In many lectures and articles the farmer has been warned not to use grain of this kind if it is possible to obtain seed of greater weight. Therefore, he generally buys seed after a partial oat failure. A typical instance of this happened in the spring of 1908. The oat crop of the previous year was very light, both in yield and weight

per bushel. Farmers sought everywhere for seed, and many importations were made from considerable distances.

That year the Iowa Agricultural Experiment Station selected for this study, twenty of the leading varieties whose seed ranged from 19½ to 32 pounds per bushel and then went into the open market and purchased the heaviest and best seed obtainable of each variety. These were sown in separate plats and later harvested.

The results obtained from this test were somewhat surprising, for it was found that other factors entered into the experiment with greater force than the weight of seed, the factor on which the work was originally based. Though in a large majority of varieties the light seed outyielded the heavy seed, it appeared that acclimation and the number of plants per acre contributed much to this result.

The outcome of this test is set forth in the following extract from the report made to the director of the station at the close of the season:

HEAVY VS. LIGHT SEED OF THE SAME VARIETY.

Conditions of Experiment.

PLAT

Location—Field H.
Size—1-20 Acre.

CLIMATE

Temperature

High	Low	Mean		**Precipitation** Rain	Snow	Clear Days
78	11	46.4	Mar. '08	0.43	....	15
83	16	50.6	April	1.94	....	14
85	26	59.2	May	7.95	....	12
88	41	66.9	June	3.93	....	6

SOIL

Kind—Prairie Loam.
Position—Somewhat Rolling.
Previous Crop—Corn.

SEED

Variety—Twenty Varieties.
Wt. per Bu.—Variable.
Source—Iowa Experiment Station and variable.
Treatment—Fanned clean and treated for smut.

SEED BED

Preparation	**Name and Condition of Machinery**		
1 Disced (lapped half)	Plow		
2 " " "	Disc	Osborn	Sharp
3 Harrow	Harrow	U-Bar	Good
4 "	Seeder	Monitor	Good
5 Seeded			
6 Harrowed			

SEEDING

Manner—Drilled.
Date—4-17-08—4-20-08.
Rate—3 Bu. per Acre by weight.

TABLE NO. 5—SHOWING THE PERFORMANCE OF HEAVY AND LIGHT SEED—20 VARIETIES.

Variable Factor				Secondary Factors							Result		
				Maturity			Frequency				Yield		
Variety	Source	Wt. per Bu. Seed	No. Seeds Sown per acre	Date Planted	Date Ripe	No. Days Growth	Smut	Leaf Rust	Stem Rust	Lodged	Height	Yield per acre	Wt. per Bu.
							%	%	%	%	In.	Bu.	Lbs.
1 Early Champion	Ia. Exp. Sta.	26	3408000	4-20-08	7-15-08	87	0	8	8	0	35	32.5	27
	Iowa Seed Co.	31	2769000	18	15	89	0	8	8	0	37	30.6	28½
2 New Sixty Day	Ia. Exp. Sta.	25	2554000	20	15	87	0	5	6	0	33	40.6	28
	Northrup-King	32	2423000	18	15	89	0	12	4	0	37	41.2	28
3 Kherson	Ia. Exp. Sta.	27½	2257000	18	16	90	0	10	5	0	36	45 0	29
	Clearwater, Neb	34	2500000	18	16	90	0	8	4	0	35	47.5	28
4 Red Texas	Ia. Exp. Sta.	32	1623000	18	30	103	0	0	10	0	37	51.2	21
	Western Mo.	36	1472000	18	30	103	0	2	15	0	36	37.5	23½
5 Swedish Select	Ia. Exp. Sta.	26½	2356000	17	27	102	0	15	50	20	42	22.5	24
	Bozeman, Mont	41	1361000	17	27	102	0	12	50	65	43	26.2	21½
6 Lincoln	Ia. Exp Sta.	21	3358000	17	26	101	0	25	20	2	40	28.1	22
	Northern Minn.	23	1643000	17	26	101	0	25	10	5	44	31.1	21
7 Silver Mine	Ia. Exp. Sta.	24	2367000	17	26	101	0	15	10	8	40	31.9	19½
	Blairstown, Ia.	31	2002000	18	26	100	0	20	20	5	41	30.0	21
8 Minn. No. 26	Ia. Exp. Sta.	23½	2495000	17	27	102	0	15	40	3	46	31.2	19
	St. Paul												
	Minn.	29	1916000	18	26	99	0	15	15	25	44	28.1	20
9 Myrick	Ia. Exp. Sta.	24½	2257000	17	26	101	0	5	25	15	45	33.1	23
	Northern Minn.	33	1607000	17	26	101	0	3	50	10	49	31.9	24
10 National	Ia. Exp. Sta.	28	2357000	20	28	100	0	20	40	98	40	19.4	17½
	Salzer Seed Co.	34	1534000	20	27	99	0	25	40	95	41	16.2	16
11 Irish Victor	Ia. Exp. Sta.	23½	2534000	20	25	97	0	25	60	25	41	25.0	14
	Tiptown, Ia.	25	2144000	20	25	97	0	35	60	40	41	25.0	14
12 Clydesdale	Ia. Exp. Sta.	19½	2573000	20	25	97	0	12	25	0	41	30.6	25
	Michigan	36	1347000	20	25	97	0	12	20	5	44	24.4	23
13 Probesteier	Ia. Exp. Sta.	26	.....	18	25	99	0	20	20	0	39	28.1	23½
	Michigan	35	1469000	20	25	97	0	20	30	10	41	26.9	21
14 Green Russian	Ia. Exp. Sta.	28	2151000	20	25	97	0	7	40	2	39	41.9	22
	Bagley, Ia.	33	2053000	18	25	99	0	12	20	15	43	36.2	21
15 Bruner	Ia. Exp. Sta.	20	2998000	20	26	98	0	10	25	2	40	20.0	19
	Rolfe, Ia.	26	2227000	20	26	98	0	5	20	2	43	39.4	23
16 White Bonanza	Ia. Exp. Sta.	21	2665000	20	26	98	0	5	15	10	41	26.2	23
	Salzer Seed Co.	37	1381000	20	26	98	0	3	40	5	41	27.5	23
17 White Russian	Ia. Exp. Sta.	22½	2188000	20	31	103	0	45	10	0	40	25.6	20
	Northern Minn.	35	1714000	20	30	102	0	75	10	8	38	23.7	24½
18 American Banner	Ia. Exp. Sta.	25	2299000	20	31	103	0	75	35	35	47	18.7	17
	North Dakota.	37	1809000	20	31	103	0	70	20	40	46	23.7	18½
19 Red Texas	Ia. Exp. Sta.	32	1623000	18	29	102	0	5	50	0	36	32.5	23
	Western Mo.	36	1472000	18	29	102	0	2	50	0	34	37.5	25
20 Swedish Select	Ia. Exp. Sta.	26½	2356000	17	23	98	0	12	40	1	42	39.4	26
	Northern Wis.	36	1374000	17	23	98	0	15	50	0	43	42.5	26
Average Light Seed	Home-Grown.	25½	2443000	19	25	98	0	16.7	26.7	11	40	31.2	22.1
Heavy Seed	Imported	33	1829000	19	25	98	0	18.9	26.8	16	41	31.5	22.2

This experiment was conducted to show the value of obtaining strong, heavy seed oats. These plats were sown at the rate of 3 bushels per acre, by weight; using 4.8 pounds per 1-20 acre plat.

The average performance and yield of the 40 plats does not show enough difference to warrant the drawing of any conclusions. Taking each variety individually, we find:

In 12 cases the light seed outyielded the heavy.

In 1 case the light seed equalled the heavy.

In 7 cases the heavy seed outyielded the light.

In considering these results, the following factors must be taken into account:

1st. The light seed was acclimated, while the heavy was bought in the open market.

2d. The light seed had 30 per cent more plants per acre than the heavy; thus some of the plats with heavy seed may have been underseeded.

The figures tend to show that the heavy and light seed were about equal, pound for pound; but not seed for seed; nor measure for measure.

As shown in the conclusions, two factors were responsible for the results in the above experiment. The effect of *size* and *weight* of seed is so confused with the factor of *acclimation* that it is necessary to study each separately. The original intent of the above experiment was to show the effect of sowing large, heavy seed. The results carry such striking evidence along the other line that it was found necessary to inaugurate an experiment to study this factor. The report of this work will be found on page 110, entitled "Buying Seed Oats Away from Home."

In order to eliminate the factor of acclimation, a second experiment was started, using our own home-grown seed graded to different degrees of "so-called" quality.

(c) IMPROVEMENT BY FANNING AND GRADING.

Two varieties were chosen for the experiment in the improvement by fanning—Kherson and Silver Mine. Six bushels of these oats were taken just as they came from the machine. A sample was saved to be used as a check, and is recorded as fanned 0 times. The remainder was put through the fanning mill. This operation was repeated until there were four samples, as follows:

Fanned 0 times
" 1 "
" 2 "
" 3 "

The seed of each was sown in a plat, first at the rate of 3 bushels per acre by weight, and then in a second plat, sowing as nearly as possible the same number of seeds per acre as were planted in the plat fanned 0 times, for Kherson 3,163,000 seeds per acre, and for Silver Mine 3,113,000 seeds per acre. The latter plats were drowned out during the growing season, and for that reason are not recorded in this report. The secondary factors

seem to be quite constant, and so are given only in the average.

	Kherson Plats	Silver Mine Plats
Date planted	4–11–08	4–11–08
Date ripe	7–16–08	7–21–08
Per cent smut	0	0
Per cent leaf rust	85	90
Per cent stem rust	65	55
Per cent lodged	30	10
Height	38 in.	43 in.

The results given in Table No. 6 show an increased yield for one fanning even after the number of seeds had been cut down about 7 per cent. Still further fanning proved beneficial to the very light Silver Mine seed, but was detrimental to the Kherson.

TABLE NO. 6—SHOWING THE EFFECT OF FANNING SEED OATS UPON THE YIELD OF THE CROP.

	Variable Factors				Result	
	Seed		Rate of seeding		Yield	Weight
	Fanned	Wt. per Bu.	Pounds per acre	Plants per acre	per acre	per Bu. Pounds
					Bu.	
Kherson	0 times	24½	96	3,163,000	49.1	25
	1 "	25½	96	2,840,000	52.2	25
	2 "	26	96	2,542,000	52.2	25
	3 "	26½	96	2,492,000	46.2	25
Silver Mine	0 times	20	96	3,113,000	27.8	18
	1 "	21	96	3,034,000	28.8	18
	2 "	22	96	2,744,000	28.8	18
	3 "	22½	96	2,581,000	29.4	18

In 1909 and again in 1910 this experiment was repeated on higher ground. The plats were arranged in sets of four, as shown in the following sketch. The figures given are the average of five trials conducted in 1909 and 1910:

Kherson				Silver Mine		
Fanned	Seeded at the rate of			Fanned	Seeded at the rate of	
	Lbs. per acre	Plants per acre			Lbs. per acre	Plants per acre
3 times	96	2,616,000	3 bu.	3 times	96	2,092,000
2 "	96	2,701,000		2 "	96	2,127,000
1 "	96	2,763,000		1 "	96	2,207,000
0 "	96	2,682,000		0 "	96	2,448,000
1 "	94	2,669,000	Equal number of Seeds	1 "	108	2,443,000
2 "	95	2,663,000		2 "	115	2,440,000
3 "	97	2,667,000		3 "	116	2,447,000

The reader should notice that the first effect of fanning is to decrease the number of seeds per weighed bushel in the ordinary sized varieties, like Silver Mine. In the small seeded varieties, like Kherson, there is an increase for the first fanning and then a decrease for further fanning, as in the case of ordinary oats. The error caused by the unequal rate of seeding in the first four plats of each variety was anticipated and provided for in the last four plats, using the zero fanned plat as a basis for each set. So we have the first set sown the same number of pounds per acre, and the last set the same number of seeds per acre (as near as our drill can be calibrated).

The result of the five trials in 1909 and 1910, nine different tests in all, have been averaged, and the results are shown in the following table:

TABLE NO. 7—SHOWING AVERAGE YIELD OF UNFANNED AND FANNED SEED OATS. 1909-1910.

Seed		Rate of seeding		Results		Rank
Variety	Fanned	Pounds per acre	Seeds per acre	Yield per acre	Weight per bu.	
				Bu.	Lbs.	
Kherson.....	0 times	96	2,682,000	60.8	30	
	1 "	96	2,763,000	60.8	29	
	1 "	94	2,669,000	63.7	29	1
	2 "	96	2,701,000	62.5	30	3
	2 "	95	2,663,000	62.7	29	2
	3 "	96	2,616,000	58.3	30	
	3 "	97	2,667,000	60.3	28	
Silver Mine.....	0 times	96	2,448,000	56.5	31	3
	1 "	96	2,207,000	54.8	32	
	1 "	108	2,443,000	50.9	31½	
	2 "	96	2,127,000	58.5	32½	2
	2 "	115	2,440,000	52.3	31½	
	3 "	96	2,092,000	61.4	31	1
	3 "	116	2,447,000	55.1	32½	

The fact that out of nine different tests in no case has the unfanned won first place, indicates that the seed was improved by fanning. Another thing is also conspicuous, namely, the rarity with which the seed fanned three times yields more than that fanned once or twice. In studying the figures obtained from all the tests, the indication shown is that seed is improved by

blowing out the empty hulls and dead or injured kernels. This usually eliminates the very small kernels and kernels carrying "pin oats." There is no indication that the very large, heavy grains are superior to the sound, medium-sized grains.

IV. BUYING SEED OATS AWAY FROM HOME.

(A History of the Importation and Cultivation of Seventy-seven Samples of Seed Oats.)

The experience of the Iowa Agricultural Experiment station, after purchasing 77 samples, representing 20 varieties of seed oats bought away from home, is that the practice is questionable.

In 1907, Mr. Don Fish, a graduate of Iowa State college, at that time located in Wyoming, procured and sent to the experiment station a sample of oats that had won the championship at the Portland Exposition. This sample was grown in Wyoming, weighed 44½ pounds per bushel and was the finest American-grown oats that had been seen at the station for several years. They were given the name "Portland" and were planted in the variety test. Later it was discovered that they came from the Irish Victor stock. Their performance in 1907, however, was so markedly different from the Irish Victor that they were not referred back to the parent stock, but were continued and have been carried to date under their new name.

PERFORMANCE RECORD IN 1907.

Variety	Irish Victor	Portland
Date Ripe	7–25–07	7–23–07
Per cent lodged	12	31
Yield per acre	28 bu.	18.7 bu.
Weight per bushel	19 lbs.	17½ lbs.

The more recent records are shown in Table No. 1, on page 98.

While this new variety did not appear promising, it was retained in order to determine if it would ever become acclimated to Iowa conditions and if so how long it would take. In the four years that this stock has been grown on the station plats, it has never equalled the parent stock. It is, however, approaching the quality of the older stock and should at the present rate equal it within the next two seasons. This test excited considerable interest, and it together with the experiment quoted on page 105 caused an exhausive study to be started upon the importation and acclimation of seed oats.

THE ACCLIMATION TEST.

In the spring of 1907, the station purchased several new varieties of oats from seedsmen. These showed such a range of variation during their first season that it was decided to repeat

the experiment for a number of years. In order to obtain comparisons, all the stocks imported have been retained by growing them from year to year the same as separate varieties. Thus, for example, we have Probesteier 1907, Probesteier 1908, Probesteier 1909, and Probesteier 1910. The date denotes the first season that this stock was grown at Ames.

In 1908 this test was enlarged so as to cover all of the prominent varieties that are being sold for seed in Iowa. While this experiment is still far from complete, the fact that thousands of bushels of seed oats are being imported annually makes the subject of unusual interest. The station has imported up to date, 77 different lots, and experience has shown that purchasing seed grown outside the corn belt is decidedly questionable for central Iowa conditions. Careful notes have been kept on every plat. The economic portion of these notes is shown in Table No. 8 and the data there recorded gives the evidence so far as we have procured it.

TABLE NO. 8.

	Yield at Ames	IMPORTED				
		1907	1908	1909	1910	1911
New Sixty Day	1907	50.1	.....	.....	.....	.....
Purchased from Northrup-King	1908	40.6	41.2	.....	.....	.....
& Co., Minneapolis. Northern	1909	50.0	40.6	39.4	.....	.....
Minnesota grown.	1910	55.3	48.1	47.5	43.4*	.....
Myrick	1907	27.8	.....	.....	.....	.....
Northrup-King & Co., Northern	1908	40.0	37.5	.....	.....	.....
Minnesota and Canadian grown.	1909	35.0	33.7	.....	.....	.....
	1910	62.5	61.9	.....	58.1	.....
	1911	.....	.....	.....	.....	.....
Clydesdale (Imp.)	1907	17.0	.....	.....	.....	.....
Peter Henderson, New York	1908	30.6	26.9	.....	.....	.....
City. Scotch grown	1909	30.3	26.9	31.2	.....	.....
	1910	53.1	51.9	50.0	48.4	....
	1911	18.7	15.2	21.8	19.1	15
Clydesdale (Dom.)	1907	20.6	.....	.....	.....	.....
Peter Henderson, Michigan and	1908	30.6	24.4	.....	.....	.....
Nova Scotia grown.	1909	30.3	27.5	31.2	.....	.....
	1910	54.7	53.1	55.6	58.7	.....
	1911	25.4	27.3	23.1	19.9	21.2
Probesteier	1907	19.3	.....	.....	.....	.....
Peter Henderson, Michigan and	1908	28.1	26.9	.....	.....	.....
Nova Scotia grown.	1909	27.5	25.3	30.6	.....	.....
	1910	66.9	68.1	65.0	70.0	....
	1911	24.9	29.8	24.8	30.9	32.5

	Yield at Ames	IMPORTED			
		1908	1909	1910	1911
Big Four	1908	30.0	.....	.....	.....
Funk Bros., Bloomington, Ill.	1909	33.4	38.7	.....	.....
Illinois grown.	1910	77.2	67.2	71.2	.....
	1911	29.6	32.4	37.6	37.2
Swedish Select	1908	35.0	.....	.....	.....
L. L. Olds Seed Co., Madison,	1909	33.1	34.7	.....	.....
Wisconsin. Northern Wisconsin grown.	1910	65.0	68.1	61.6	.....
	1911	27.7	20.3	34.2	37.7
Swedish Select	1908	26.2	.....	.....	.....
Montana Exp. Sta., Bozeman,	1909	23.1	28.1	.....	.....
Montana. Irrigated Seed.	1910	61.6	65.3	67.8	.....
	1911	30.6	36.8	35.3	34.4
Swedish Select	1908	17.2	.....	.....	.....
Colorado Experiment Station,	1909	33.1	35.6	.....	.....
Ft. Collins, Colorado. Irrigated Seed.	1910	71.2	66.9	70.9	.....
Swedish Select	1908	15.0	.....	.....	.....
Garton-Cooper Seed, Sugar	1909	28.8	31.2	.....	.....
Grove, Illinois. English grown.	1910	67.8	64.4	65.9	.....
	1911	30.1	30.3	29.2	15.1
Progress	1908	15.6	.....	.....	.....
Montana Experiment Station.	1909	23.1	30.0	.....	.....
Irrigated Seed.	1910	60.3	65.3	65.0	.....
	1911	22.6	30.1	25.6	31.2
White Bonanza	1908	27.5	.....	.....	.....
Salzer Seed Co., LaCrosse, Wis-	1909	29.7	30.3	.....	.....
consin. Northern Wisconsin	1910	60.9	65.0	62.5	.....
and Canadian grown.	1911	21.8	22.5	27.9	30.
National	1908	16.2	.....	.....	.....
Salzer Seed Co., Northern Wis-	1909	28.1	41.2	.....	.....
consin and Canadian grown.	1910	65.9	72.2	56.5	.....
	1911	28.8	25.6	25.5	37.1
Great American	1908	20.6	.....	.....	.....
Funk Bros. Illinois grown.	1909	34.4	38.1	.....	.....
	1910	66.2	74.1	72.2	.....
	1911	28.4	33.1	32	30.1
Lincoln	1908	31.1	.....	.....	.....
Northrup-King & Company.	1909	34.4	35.0	.....	.....
Montana grown.	1910	66.6	68.1	66.6	.....
	1911	36.	19.6	24.3	29.6
Minnesota No. 26	1908	28.1	.....	.....	.....
Minnesota Experiment Station.	1909	29.4	33.7	.....	.....
Minnesota grown.	1910	59.4	62.4	62.5	.....
	1911	20.8	24.8	19.8	20.5

	Yield at Ames	IMPORTED			
		1908	1909	1910	1911
Red Texas.....	1908	37.5	.....	.....	.....
Funk Bros. Missouri grown.	1909	32.8	31.2	.....	.....
	1910	62.5	67.8	59.4	.....
	1911	6.6	7.6	4.8	30.2**
White Russian.....	1908	23.7	.....	.....	.....
Northrup-King & Company.	1909	45.6	43.1	.....	.....
Montana grown.	1910	55.3	55.0	.....	***
Colorado No. 37.....	1908	16.9	.....	.....	.....
Colorado Experiment Station	1909	41.6	42.2	.....	.....
Irrigated Seed.	1910	41.6	57.2	51.2	.....

*Not Sixty Day.
**Not Red Texas.
***Not White Russian.

A PROFITABLE ANALOGY.

Before studying this experiment in detail, the reader should bear in mind the following analogy:

The longer the growing season of any community, the larger and heavier seeds it can produce.

The growing season of corn is cut off by the early frosts. If it is cut off by hot winds, the corn fires and produces light seed, if any at all. The average Iowa farmer tries to raise a variety of corn that will ripen naturally just about the time of the first frost. He even goes so far as to prefer to stand the damage occasionally, rather than to grow the smaller varieties. Corn is a hot climate plant: Its growing season is terminated by a lack of heat (frost).

The oat, on the contrary, is a cool climate plant. It ripens naturally long before frost in the corn belt, and its growing season is terminated by—what?—excess of heat (hot weather). For a maximum crop the oat plant must be fully developed and the kernels must be filled, but not necessarily ripe, before severe hot weather sets in. Otherwise, the seeds are ripened prematurely

NOTE.—For the scientific reader I wish here to call attention to the evidence of the action of pure lines or strains in these samples. Our notes show that these varieties have usually been true to variety type in a general way. The range of variation, however, runs from 0 to 100 per cent. To the farmer this way be translated as follows. Out of 77 importations, 73 have been 96 per cent or more true to variety type, 1 has been about 5 per cent true to type, and 3 have been of a different variety from the one named. For the plant breeder we may say that out of the 77 importations, there are about 60 that do not show the degree of trueness that should exist where seeds are sold under a variety name. In explanation of this fact the following suggestion is offered: The seedsmen knew the nature of the test and endeavored to send the best seed obtainable. Different seasons brought this seed to them from different sections of their territory. These varieties had been grown for some time in these various communities and had developed the elementary species or pure lines of which they were originally composed, in different proportions under the different environment.

and there is light weight per bushel. In studying this experiment, keep in mind the normal ripening time in the countries from which the varieties were obtained.

This work brings out a few very valuable points for the soil and climatic conditions that exist at Ames.

For purposes of comparison the thirteen varieties that have been delivered to us true to name throughout the experiment have been arranged into six groups according to the locality from which they were received. In addition to this, the yield of six of Iowa's most common varieties has been appended to this table:

TABLE NO. 9—SHOWING YIELD IN 1910 AND 1911 OF SEED IMPORTED AT DIFFERENT DATES.

	Yield in 1910			Yield in 1911				Average Yield		
	Imported in			Imported in				From Importation		
Imported From Variety	1908	1909	1910	1908	1909	1910	1911	3rd crop	2nd crop	1st crop
British Isles										
Clydesdale	51.9	50.0	48.4	15.2	21.8	19.1	15.0	36.8	34.5	31.7
Swedish Select	67.8	64.4	65.9	30.1	30.3	29.2	15.1	49.0	46.8	40.5
Average	59.8	57.2	57.1	22.6	26.0	24.1	15.0	42.9	40.6	36.1
Montana										
Swedish Select	61.6	65.3	67.8	30.6	36.8	35.3	34.4	49.2	50.3	51.1
Progress	60.3	65.3	65.0	22.6	30.1	25.6	31.2	45.2	45.4	48.1
Lincoln	66.6	68.1	66.6	36.0	19.6	24.3	29.6	43.1	46.2	48.1
Average	62.5	66.2	66.5	29.7	28.8	28.4	31.7	45.8	47.3	49.1
Michigan										
Clydesdale	53.1	55.6	58.7	27.3	23.1	19.9	21.2	38.1	37.7	38.8
Probesteier	68.1	65.9	70.0	29.8	24.8	30.9	32.5	46.4	48.4	51.2
Average	60.6	60.7	64.3	28.5	23.8	25.4	26.8	42.2	43.0	45.0
Wisconsin										
Swedish Select	65.0	68.1	61.6	27.7	29.3	34.2	37.7	47.1	51.1	48.6
White Bonanza	60.9	65.0	62.5	21.8	22.5	27.9	30.0	41.7	46.4	46.2
National	65.9	62.2	56.5	28.8	25.6	25.5	37.1	45.7	48.8	46.8
Average	65.9	68.4	60.2	26.1	25.8	29.2	34.9	43.8	48.8	47.2
Minnesota										
Minnesota No. 26	59.4	62.4	62.5	20.8	24.8	19.8	20.5	42.1	41.1	41.5
Illinois										
Big Four	77.2	67.2	71.2	29.6	32.4	37.6	37.2	54.8	52.4	54.2
Great American	66.2	74.1	72.2	28.4	33.1	32.0	30.1	49.6	53.0	51.1
Average	71.7	70.6	71.7	29.0	32.7	34.8	33.6	52.2	52.7	52.6
General Average	63.4	64.9	63.8	26.8	27.2	28.6	28.6	45.3	46.3	46.0

		1910	1911	Avg.
Home grown seed.	Kherson	62.2	38.1	50.1
	Silver Mine	70.6	36.3	53.4
	Green Russian	64.1	31.8	47.9
	Swedish Select	62.2	25.5	43.8
	Early Champion	61.9	35.0	48.4
	White Russian	60.0	19.8	38.9
	Average	63.5	32.2	47.1

The figures in the Table No. 9 give the results of two years' records. These seasons were representative of Iowa's weather conditions. The year 1910 was particularly favorable to the production of oats, while 1911 was much less so. The averages of these two seasons' results compare very favorably with long-time average in other tests.

ACCLIMATION AND IMPORTED SEED.

For purposes of convenience, we will discuss first the effect of acclimation upon imported seed. Keep in mind the two preceding paragraphs, and note the yields in the first season of seed that had been brought from the British Isles.

The average yield in 1910 and 1911 for the first crop from imported seed was 36.1 bushels per acre; for the second crop or

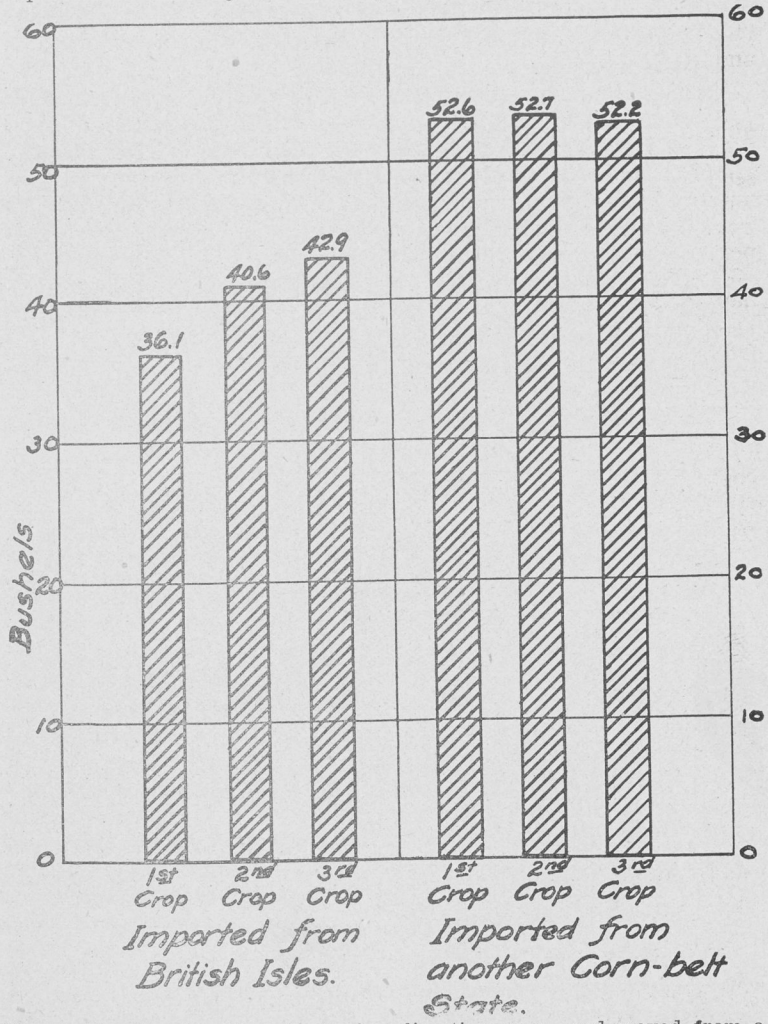

Figure II.—Showing the effect of acclimation upon seed moved from a favorable location to another less favorable, also from one state to another where the change of climate was very pronounced.

the crop raised from seed produced by the first crop, was 40.6 bushels per acre; and for the third crop, or the crop raised from seed produced by the second crop, was 42.9 bushels per acre.

The normal date of ripening for these seeds in their native country is late in August. The normal date of ripening for oats at Ames is very early in July. Note that they were damaged less and less with each succeeding generation. Note, too, that the greatest change is produced after the first crop from importation. The plant endeavors to adjust its habits to the surroundings as quickly as possible.

In this connection the reader should note the performance of seed brought from farther south where the normal date of ripening is still earlier than at Ames. The seed imported from central Illinois yielded 52.6 bushels per acre in the first crop, 52.7 bushels per acre in the second crop, and 52.2 bushels per acre in the third crop. Note the small rise in the second crop over the first. This happens so many times that it is important. It does not, however, have a frequency of 50%, if we consider the total number of importations.

It is evident from the above that the first season's test is the most severe that a farmer will be able to give an imported seed oat.

The next question that arises is how do the various territories compare in the value of their seed oats. If we select two varieties of the same general type from each of the above territories, we find that:

Illinois grown seed, Big Four and Great American, yields 52.6 bu.
Montana grown seed, Swedish Select and Progress, yields 49.6 bu.
Wisconsin grown seed, Swedish Select and National, yields 47.7 bu.
Michigan grown seed, Clydesdale and Probesteier, yields 45.0 bu.
British grown seed, Clydesdale and Swedish Select, yields 36.1 bu.

Bearing in mind that seed moved from a long season territory to one of shorter growing season may be damaged by immaturity, note that the reverse is also true, that short-seasoned territories produce oats better adapted to a longer-seasoned territory than the ones usually grown there. The two best varieties at Ames, Kherson and Silver Mine, yielded 51.7 bushels. The only territory which is not in accord with this is Montana. It will require more data before a reliable statement can be made in regard to the general yield of seed from that state. We will also have to distinguish between irrigated and dry-farming seed.

IMPORTED SEED NOT BETTER.

Taken as a whole, the imported seed is not better than the average home-grown seed. The figures also show that the best imported seed we have ever received is but slightly better. (This seed was from Illinois.) In a strict sense of the term, this is not imported seed.

Average yield from imported seed, 1910-1911, first crop....46.0 bu.
Average yield from home-grown seed, 1910-1911.....47.1 bu.
Yield from best crops from seed received, 1910.
Illinois Great American.....72.2 bu.
Illinois Big Four.....71.2 bu.
Michigan Probesteier .....70.0 bu.
Home grown, Silver Mine.....70.6 bu.
Yield from best crops from seed received, 1911.
Wisconsin Swedish Select.....37.7 bu.
Illinois Big Four.....37.2 bu.
Wisconsin National .....37.1 bu.
Home grown, Kherson .....38.1 bu.
Home grown, Silver Mine.....36.3 bu.

There is one more factor that it is well for us to consider before summing up this experiment. The reader will notice that the leading variety grown in each of the territories studied was the one which we purchased for this experiment. This was done because they were the varieties most likely to be advertised for the Iowa farmer to purchase. Note that in the table the Clydesdale or Swedish type predominates; now turn back to the variety test and note that this type is not the one best adapted to central Iowa conditions. In other words, the varietal difference has not been overshadowed by the difference due to climate, except in the case of those importations coming from the British Isles.

CONCLUSIONS FROM IMPORTED SEED TEST.

In summing up this experiment as a whole, the work so far as it has progressed shows the following tendencies:

First. Seedsmen are, as a rule, careful to send seed true to variety name. Only four instances of carelessness or bad faith have so far been noted.

Second. Samples sold from year to year under the same name do not, as a rule, conform to a single type of plant, nor do these samples carry a limited number of types in the same proportion. Variation and mixture have taken place in different proportions in the various fields from which the samples have been originally obtained. (At the Iowa station it is not considered that this point seriously affects yield or weight per bushel.)

Third. The figures seem to show that seed oats become better adapted to a given environment by being grown under the conditions which the environment affects. In the 1910 test only four of the nineteen new importations yielded as well as the same varieties that had been acclimated for one and two years. The loss occasioned by importation seems to be in direct proportion to the amount of change of environment occasionad by their travel.

Fourth. The imported seed makes its most radical increase in the second crop.

Fifth. The quality of seed used does not seem to be as important a factor as acclimatization. This point is noticeable

within certain limits. Seed seriously injured by lack of acclimatization requires at least one more season to become even normal. (See Regenerated Swedish Select 1907 importation.) In seasons when Iowa offers a climate somewhat similar to that under which the imported seed is usually grown, the differences between imported and home-grown seed are markedly less. If Iowa's seasons were uniformly like those of 1906 and 1910, the problem of importation would not be serious.

Sixth. Northern-grown seed is not superior for corn-belt conditions.

Seventh. The best corn-belt seed is better than the farmer is likely to purchase elsewhere.

Eighth. Where importations have been made with successful results, the increase has been due to the securing of a better adapted variety and not to the quality of the seed which was purchased.

V. SOME PRACTICES WHICH INCREASE THE YIELD OF OATS.

a. Preparation of Seed Bed to a Uniform Depth and Surface.
b. Fanning Seed.
c. Treating Seed for Smut.
d. Sowing with a Drill.
e. Sowing Plenty of Seed.
f. Cutting as Soon as Ripe.
g. Shocking.
h. Stacking.

In order to give a maximum crop of any grain, a field must present an even stand of uniform plants. Fields that look ragged sometimes yield more than the one across the fence that has been properly tended; but this is no argument that the piece in question could not have been improved by the adequate treatment.

There are four factors that go to produce an even crop:

1. Uniform land.
2. Uniform tillage.
3. Uniform seed.
4. Uniform distribution of seed.

UNIFORM LAND AND TILLAGE.

The prairie land of the state of Iowa deserves but little criticism from the standpoint of the oat crop. The tillage of this land for oats, however, is one of the most neglected practices in the agriculture of the state. Two or three times over a stalkfield with a dull disc and harrow is considered by too many farmers to be all that is necessary for oats. The ridges from the last year's cornfield are left so that they are apparent all through the season, and even the next year in the clover. The water from rains runs down into the hollows between these ridges in the early part of

the season, causing the ground to pack, and thus retard the growth of the plants. The few that are able to survive get yellow and spindly. The whole piece is striped like a prison suit.

The depth to which oat ground should be tilled varies with the soil and season. Corn stubble will usually produce a fair crop if prepared well to a depth of two to two and a half inches. Our best crops, however, have been raisd upon land tilled to a depth of four inches. The seed should not be put in more than one inch below the surface.

The first item in the production of good oats is to prepare the land to a *uniform surface* and to a *uniform depth.*

UNIFORM SEED.

Fanning and grading seed oats has been discussed in the earlier pages of this bulletin. The figures show that fanning seed once or twice improves the crop. Well-fanned oats will usually give a germination test above 90 per cent, but if they have at any time heated in the bin, they should be tested for vitality. This may be done easily in a box of dirt or sand, set in among the house plants, or in any light room that is not allowed to freeze.

There is another factor of importance from the standpoint of uniform seed, namely, smut. The fanning mill will not eliminate oats smut from the seed oats.

SMUT IN OATS.

From the calculations received from several hundred inquiries, it is a safe estimate that about 5 per cent of Iowa's oat crop is annually destroyed by smut. This means about two bushels per acre, or from 80 to 100 bushels on each farm every season. To prevent this loss would cost about $1.00 in formaldehyde and $1.00 in labor for each forty acres. In other words, the Iowa farmer sells his first 100 bushels of oats for two cents per bushel. The prevention of this loss is a very simple proposition.

Oat smut is a minute plant that grows in the tissue of the oat plant. The only parts that are visible to the naked eye are the masses of seeds (spores) by which it reproduces. These ripen and are ready for their period of rest just about the time the oat plant is in flower. The chaff is then loose and open and the wind blows these spores over the field, allowing them to lodge on the young berries that are forming. Here they stick fast until the seed is planted and the young oat plant begins to grow. At this time the smut spore starts to develop, sending its filaments into the young oat plant and taking up its nourishment.

The time to kill the smut is while it is in the granary. The simplest method is to use a poison that will not injure the oats, but is fatal to the little spore. Formaldehyde gas is such a poison.

Commercial formaldehyde is a water solution of formaldehyde gas. This solution comes in varying strengths, but the one com-

monly sold and the one upon which all calculations are based is 40 per cent. Care should be taken that the bottles and cans in which this solution is kept are always corked tight, as the gas escapes very readily and the solution loses strength. If there is any doubt regarding the strength of the formaldehyde you expect to use, a sample should be sent to the Experiment Station Chemist for analysis.

TREATING SEED OATS WITH FORMALDEHYDE.

One pound (pint) of formaldehyde in 40 gallons of water will treat 40 bushels of oats. The equipment needed is a clean floor, a barrel, a sprinkling can, a scoopshovel and plenty of blankets, sacks or tarpaulin. Proceed as follows:

1. Spread out 40 bushels of oats on the floor five or six inches deep.

2. Mix one pound of formaldehyde (40%) with 40 gallons of water. Stir well.

3. Sprinkle the oats with the mixture in the barrel until they are saturated. It is well at this point for one man to shovel the oats into a pile while another sprinkles. They are not exposed to the air for so long a time and less gas is lost. See that the pile is thoroughly soaked when finished.

4. Cover the pile at once with the blankets and sacks so as to keep the gas in where it will be effective. (It is this free gas that does the work.)

5. Leave the pile covered for six to ten hours (over night), then remove the blankets and shovel out thin to dry. Shovel them over from time to time.

These oats may be sown as soon as they are dry enough to run through the drill. Make allowance for the swollen condition of the seed in setting the drill. It is a convenient plan to treat the oats late in the afternoon, then they can be left over night in the pile without danger of heating.

If more oats are treated than are needed for seed, they may be fed after one or two days. All the gas will have escaped.

UNIFORM DISTRIBUTION OF SEED.

It is impossible to sow oats evenly by hand, or with an end-gate seeder, and it is impossible to cover to a uniform depth after any kind of a broadcast seeder. Just how much this non-uniformity will affect the uniformity of the plants lies largely with the weather conditions. If there is an abundance of rain the difference caused by depth is reduced. The spotted condition caused by uneven distribution is never entirely overcome.

It is impossible to use an end-gate seeder on the experimental plats, but the relative effect of uniformity in depth of covering has been tested at this station for a number of seasons. The results are shown in the following table:

TABLE NO. 10—SHOWING THE RELATIVE EFFECT OF DRILLING AND BROADCASTING UPON THE YIELD OF OATS.

Season	Variety	Rate Seeding	Yield per acre	
			Drilled	Broadcast
1907	Kherson	2½ bu.	54.3 bu.	46.4 bu.
	Silver Mine	2½ "	35.6 "	24.2 "
1908	Kherson	3 "	41.4 "	41.4 "
	Silver Mine	3 "	17.6 "	17.9 "
1909	Kherson	3 "	37.8 "	35.0 "
	Silver Mine	3 "	55.3 "	55.3 "
1911	Iowa No. 156	3 "	43.1 "	33.1 "
	Iowa No. 157	3 "	40.6 "	41.9 "
	Average		40.7 "	36.9 "
	Value at 33 1-3c per bu.		$13.57	$12.30

Average loss per acre occasioned by broadcasting, $1.27 per acre.

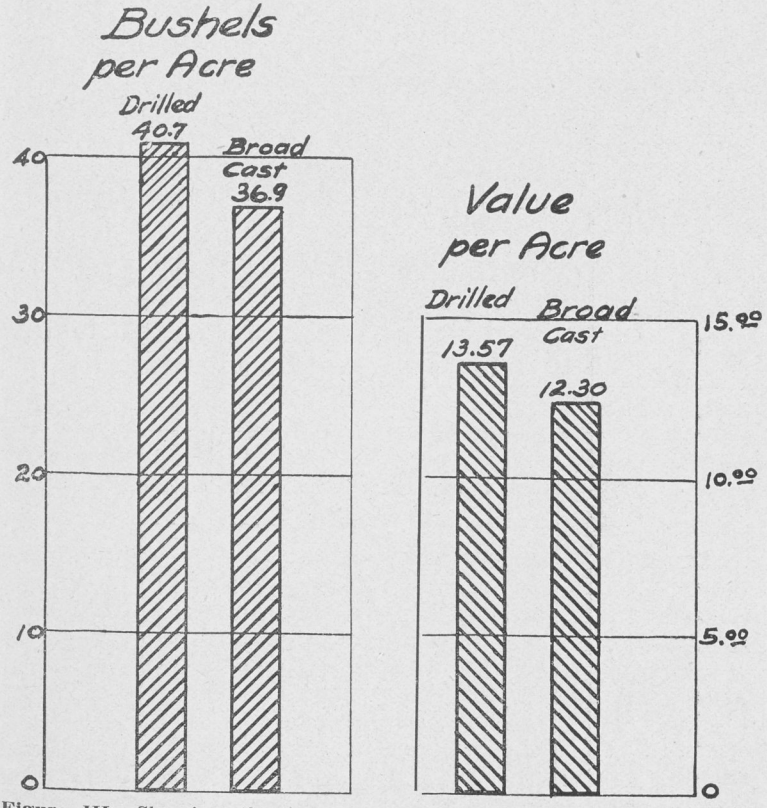

Figure III.—Showing the results of drilling vs. broadcasting of oats in 8 trials.

The diagram above shows a difference of almost four bushels per acre as the average gain from drilling the seed. At the rate of 33 1-3 cents per bushel this amounts to $1.27 per acre. The difference in yield on eighty acres will buy a good drill.

The reader should note in the preceding Table No. 10 that drilled oats have not always outyielded the broadcast. The above figures are for a four-year average. One thing is certain, that drilling is never detrimental, unless the seed is put in too deep. This is a matter that depends upon the judgment of the farmer. It is not advisable to use a drill in the mud. Taking everything into consideration it is safe to say that every farmer should own a drill, and should use it whenever the land is dry enough to permit.

RATE OF SEEDING.

Closely allied with the uniformity of distribution and depth of seeding is the thickness of seeding. In oats this is almost entirely governed by the amount of seed sown. For the past six years this station has conducted experiments to ascertain the optimum rate. The test plats have always been sown with a disc drill, using from four to twelve pecks per acre.

From the tests in 1906 and 1907, it became evident that in some seasons three bushels were insufficient, and thus higher rates were sown, up to 4½ bushels. It was also evident that in no case would less than two bushels be sufficient, so the lesser plats were dicontinued.

One early and one medium variety were used. The results obtained from each are shown in the following Table No. 11. All measurements are made by weight (1 bu. equals 32 lbs.)

TABLE NO. 11—SHOWING THE EFFECT OF RATE OF SEEDING UPON YIELD PER ACRE—1906 TO 1911.

Variety and Rate of Seeding	YIELD PER ACRE							
	1906 Bu.	1907 Bu.	1908 Bu.	1909 Bu.	1910 Bu.	1911 Bu.	Av. for 08 to 11 Bu.	Av. for 6 yrs. Bu.
Kherson								
1 bu.— 32 lbs.	61.2	40.9						
48 "	69.3	48.7						
2 bu.— 64 "	66.9	50.9	31.1	26.4	79.2	60.8	49.4	52.7
80 "	74.3	45.6	37.5	30.6	78.5	60.2	51.7	54.6
3 bu.— 96 "	74.3	53.1	44.1	28.8	80.5	61.2	53.7	56.9
112 "			46.2	34.4	78.5	61.6	55.2	
4 bu.— 128 "			46.2	40.0	78.5	60.8	56.3	
144 "			49.4	42.2	79.2	58.5	57.3	
Silver Mine								
1 bu.— 32 lbs.	54.7	22.5						
48 "	67.9	24.6						
2 bu.— 64 "	62.5	27.8	21.9	24.1	67.9	52.7	41.7	42.6
80 "	65.0	28.4	25.6	24.1	66.5	53.9	42.5	44.1
3 bu.— 96 "	77.5	35.6	29.7	42.2	71.2	54.3	49.3	51.7
112 "			30.6	40.0	69.9	52.3	48.2	
4 bu.— 128 "			29.7	42.2	71.2	53.3	54.1	
144 "			31.1	46.9	66.5	50.4	48.7	

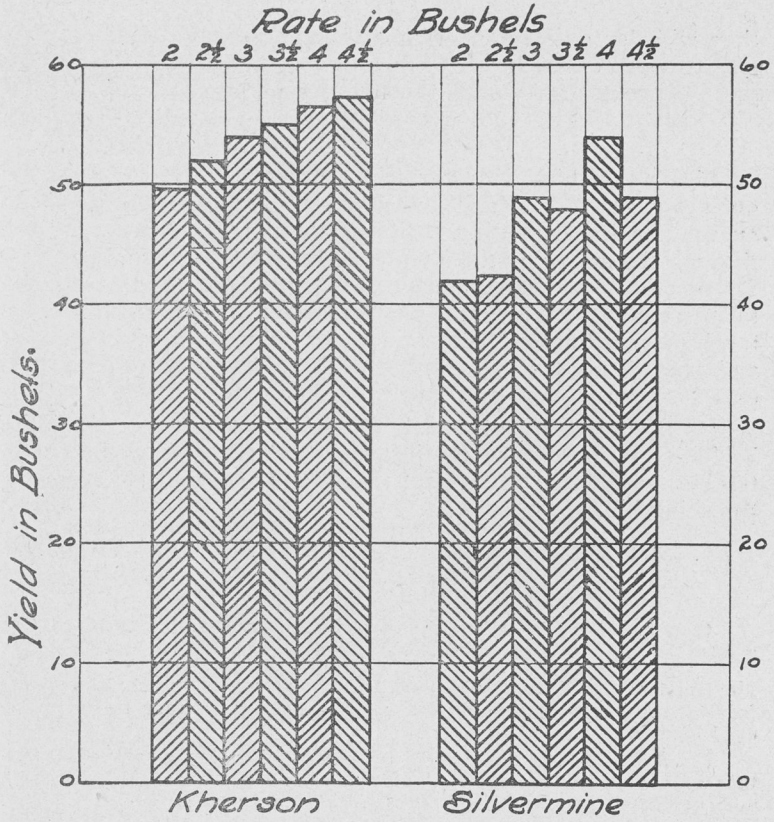

Figure IV.—Showing the effect of rate of seeding upon yield per acre.

The figures shown here indicate that the average farmer is planting too little seed. Note should be made of the fact that in exceptional oat seasons like 1910, the effect is not so marked as it is in the average of several seasons.

CUTTING.

The average Iowa farmer cuts his oats at about the proper time; that is just before the heads turn yellow. There are two or three days just before maturity when the heads are white, but are not entirely ripe. Oats cut at this period will ripen and cure in the shock, giving a brighter color, and are not so likely to "shatter" as when they are left until they get dead ripe.

SHOCKING.

Opinions differ regarding the form of shock which it is best to use. This will vary with the ripeness of the bundles. Round shocks should be of medium size, open enough at the base so that

they will dry quickly and capped so as to expose the least possible amount of the heads to the sun and dew. The color of the grain depends largely upon these two points in shocking.

SHOCK THRESHING.

Shock threshing is a pernicious practice. After a man has gone to the trouble to raise and harvest a crop of oats there is no excuse for his damaging their palatibility by "putting them through the sweat" in the bin. Oats can be stacked and threshed for practically the same money as when they are hauled directly to the machine. When oats are "sweat out" in the stack there is much more air around the grain and it comes out bright in color and crisp in texture. There is usually at least one grade difference between stacked and shock threshed oats.

Do not be afraid of a little wind when threshing; the light, half-filled berries are worth just as much in the straw pile as in the bin, in addition to the fact that they are eliminated from the threshing bill.

*VI. HOW OATS ARE GRADED ON THE CHICAGO MARKET.**

Oats received by the Illinois grain inspectors in Chicago are graded No. 1, No. 2, Standard, No. 3, No. 4.

No. 1 White Oats shall be white, dry, sweet, sound, bright, clean, free from other grain and weigh not less than 32 pounds to the measured bushel.

No. 2 White Oats shall be 95 per cent white, dry, sweet, shall contain not more than 1 per cent of dirt, and 1 per cent of other grain and weigh not less than 29 pounds to the measured bushel.

Standard White Oats shall be 92 per cent white, dry, sweet, shall not contain more than 2 per cent of dirt and 2 per cent of other grain and weigh not less than 28 pounds to the measured bushel.

No. 3 White Oats shall be sweet, 90 per cent white, shall not contain more than 3 per cent of dirt and 5 per cent of other grain and weigh not less than 24 pounds to the measured bushel.

No. 4 White Oats shall be 90 per cent white, may be damp, damaged, musty or very dirty.

No. 1 Mixed Oats shall be oats of various colors, dry, sweet, sound, bright, clean, free from other grain, and weigh not less than 32 pounds to the measured bushel.

No. 2 Mixed Oats shall be oats of various colors, dry, sweet, shall not contain more than 2 per cent of dirt and 2 per cent of other grain and weigh not less than 28 pounds to the measured bushel.

No. 3 Mixed Oats shall be sweet oats of various colors, shall not contain more than 3 per cent of dirt and 5 per cent of other grain and weigh not less than 24 pounds to the measured bushel.

No. 4 Mixed Oats shall be oats of various colors, damp, damaged, musty or very dirty.

*Board of Trade Report, Chicago.

No. 1 Red Oats or Rust Proof shall be pure red, sound, bright, clean and free from other grain and weigh not less than 32 pounds to the measured bushel.

No. 2 Red Oats or Rust Proof shall be seven-eighths red, sweet, dry and shall not contain more than 2 per cent of dirt or foreign matter, and weigh not less than 30 pounds to the measured bushel.

No. 3 Red Oats or Rust Proof shall be sweet, seven-eighths red, shall not contain more than 5 per cent of dirt or foreign matter, and weigh not less than 24 pounds to the measured bushel.

No. 4 Red Oats or Rust Proof shall be seven-eighths red, may be damp, musty or very dirty.

No. 1 White Clipped Oats shall be white, clean, dry, sweet, sound, bright, free from other grain, and weigh not less than 35 pounds to the measured bushel.

No. 2 White Clipped Oats shall be 95 per cent white, dry, sweet, shall not contain more than 2 per cent of dirt or foreign matter, and weigh not less than 32 pounds to the measured bushel.

No. 3 White Clipped Oats shall be sweet, 90 per cent white, shall not contain more than 5 per cent of dirt or foreign matter, and weigh not less than 30 pounds to the measured bushel.

No. 4 White Clipped Oats shall be 90 per cent white, damp, damaged, musty or dirty, and weigh not less than 30 pounds to the measured bushel.

No. 1 Mixed Clipped Oats shall be oats of various colors, dry, sweet, sound, bright, clean, free from other grain, and weigh not less than 35 pounds to the measured bushel.

No. 2 Mixed Clipped Oats shall be oats of various colors, dry, sweet, shall not contain more than 2 per cent of dirt or foreign matter, and weigh not less than 32 pounds to the measured bushel.

No. 3 Mixed Clipped Oats shall be sweet oats of various colors, shall not contain more than 5 per cent of dirt or foreign matter and weigh not less than 30 pounds to the measured bushel.

No. 4 Mixed Clipped Oats shall be oats of various colors, damp, damaged, musty or dirty and weigh not less than 30 pounds to the measured bushel.

Purified Oats. All oats that have been chemically treated or purified shall be classed as purified oats, and inspectors shall give the test weight on each car or parcel.

NOTE.—Inspectors are authorized when requested by shippers to give weight per bushel instead of grade on Clipped White Oats and Clipped Mixed Oats.

VII. CLASSIFICATION OF OAT TYPES FOR PREMIUM LISTS.

The following forms are offered to aid secretaries of shows in classifying types of oats in such a manner that merit in a sample can be acknowledged by the judge.

The extreme difficulty in judging oat classes where a number of types compete for the same money, is acknowledged by all judges. The following suggestions may help to remove some of the difficulty:

PREMIUM SERIES 500 OATS.

Small Early Oats.

Premium No. 501 White Champion Type.
1st
2d
3d

502 Colored Kherson Type.
1st
2d
3d

Medium Oats—White.

503 White Silver Mine Type.
1st
2d
3d

504 White Swedish Type.
1st
2d
3d

505 White Bonanza Type.
1st
2d
3d

Colored.

506 Yellow Green Russian Type.
1st
2d
3d

507 Colored other than Yellow—Joanette, etc., type.
1st
2d
3d

Late Oats—Side Oats.

508 White—White Russian Type.
1st
2d
3d

509 Colored Golden Giant and Black Beauty Type.
1st
2d
3d

Rust Proof.

510 Red Oats—Red Texas Type.
1st
2d
3d

A form which will be found more convenient for small shows and which will give satisfaction in large ones where the state is districted is presented in the following:

PREMIUM SERIES 500 OR CLASS O OATS.

Premium No. 501
Class O sub 1
Small early White Oats—Champion Type.
1st
2d
3d

Premium No. 502
Class O sub 2
Small early Colored Oats—Kherson Type.
1st
2d
3d

Premium No. 503
Class O sub 3
Large, medium, White Oats—Silver Mine, Swedish and Bonanza Type.

Premium No. 504
Class O sub 4
Large, medium, Colored Oats—Green Russian Type.

Premium No. 505
Class O sub 5
Late White Oats (side)—White Russian Type.

Premium No. 506
Class O sub 6
Late Colored Oats (side)—Golden, Giant and Black Beauty Type.

Premium No. 507
Class O sub 7
Late Red Oats—Red Texas, Rust Proof.

The use of the premium number instead of the class and sub-class is being followed by many shows with much success. It is of course immaterial, as both methods are well understood by the public.

For county shows and small clubs, the above classification may be reduced as follows:

Early oats	White or yellow	Champion and Kherson	1st—2d—3d
Medium oats	White or yellow	Silver Mine, Green Russian and Bonanza	1st—2d—3d
*Late side oats	White or yellow	White Rus. Golden Giant	1st—2d—3d
*Late side oats	Black	Black Beauty	1st—2d—3d
*Red oats	Rust proof	Red Texas	1st—2d—3d

*Optional with management, but had better be given small premiums.

NOTE.—Any other types shown in Iowa will be raised for show purposes, not for economic use.

The bulk of the honors should be distributed among subclasses 1, 2, 3 and 4, as they are the economic types of the state. The printing of the subclasses 5, 6 and 7 with small premiums, bars varieties which experience has shown to be inferior, from showing (and in some seasons winning) against large classes of the more profitable types.

Sweepstakes may be offered, if it should seem desirable, between subclasses 1 and 2; and also between subclasses 3 and 4; but further than this it would be just as consistent to ask a judge to place a class containing Hampshire, Lincoln and Merino sheep or Tamworth and Berkshire hogs.